JPRS 77383

13 February 1981

USSR Report

TRANSPORTATION

No. 34

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NOTE

PROCUREMENT OF PUBLICATIONS

JPRS 77388

13 February 1981

USSR REPORT

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 [III - USSR - 38d]

AIR

BETTER USE OF FLIGHT SIMULATORS URGED

Moscow GRAZHDANSKAYA AVIATSIYA in Russian No 12, 1980 p 18

[Article by I. Tarashchan, chief of a department of Order of Lenin Ul'yanovsk Higher Flight Training School of Civil Aviation, Honored Pilot of USSR, from city of Ul'yanovsk: "Components of Flight Safety: Make Fuller Use of Trainers"]

[Text] There probably is no need to speak once again about the use of simulators in increasing the effectiveness of flight personnel training. They have become a firm part of Aeroflot's subunits and training institutions. The question is posed differently today: how to attain precise and productive organization of practices on simulators and create a psychological situation in a class so that it approaches reality in its intensity, stress, and content of actions and thoughts.

In this article I would like to share the experience of using simulators in training students at the Order of Lenin Ul'yanovsk Higher Flight Training School. The chief element for which we strive and which we attained is the systematic character of classes and uniformity of training methodologies on the simulator and primary trainer. We try to arrange the work so that a student's transition from the simulator to the aircraft is a logically justified and technically substantiated continuation of training and the honing of flying proficiency.

It is poor when simulator training is conducted in isolation from an improvement of practical flying skills under actual flight conditions. For this reason we try to observe an important methods rule during simulator practices of preventing the development of improper flying habits, promptly identifying the reasons for mistakes in piloting, analyzing them carefully and, most important, arming the student with recommendations for remedying them.

Successful student training on simulators depends largely on the extent to which an instructor has mastered pedagogic expertise. This expertise is formed above all from a detailed knowledge of the Flight Manual on a particular aircraft, good methods training, and an ability to find and competently apply the most effective forms of training. This is even more important under conditions of the ever growing demands placed on the training of flight personnel involving mastery of new equipment and flying in bad weather conditions.

To increase instructors' proficiency, the department for operation of technical flight training equipment (simulator department) at the ShVLP [Advanced Flight

Training School] holds monthly days of instructors' theoretical training. The classes give attention not only to deepening knowledge in technical disciplines, but also to training methodology, the psychology of flying, and pedagogics. The school makes it a constant practice for simulator instructors and flight subunit instructors to attend mutual classes and for open (demonstration) lessons to be held at which flight command personnel and instructors of flight training subunits are present.

The opinion exists among pilots that a simulator class is a usual matter and so it is not worthwhile to burden oneself with good ground training. But practical experience suggests that the success of simulator classes is forged in solid training on the ground. This is why an orderly and precise system of classes has become established at the ShVLP, and they are held in specially prepared training classrooms for a specific type of aircraft: Tu-154, Tu-154B, Tu-134 and Tu-134A.

These classrooms are outfitted so that a trainee not only can hear the instructor, but also see the layout of on-off switches, change-over switches, panels and instruments. To this end workers at the ShVLP made large-scale planar mock-ups of pilot cockpits. It is as if the student is in the aircraft: Before him is the instrument panel, flying field, VPP [runway] and so on. Here too are the diagrams, posters, slide films, mock-ups, slide projectors, and didactic material on the topic that are needed for classes.

It stands to reason that the quality of classes depends above all on how the instructor prepares for it. Tu-154 simulator instructors V. S. Denisenko, V. M. Gerasimov, N. Ye. Gerasimov and G. S. Lepeshkov, Tu-134 simulator instructors A. I. Yetoshkin, N. V. Nemchinov and D. S. Shakirov and Il-18 simulator instructors L. Ye. Bashov and others have an imaginative and knowledgeable attitude toward student ground training. In drawing up the lesson plans they skillfully use all basic flight documents (the Flight Manual, methodology for performing a flight, and recommendations for a given type of aircraft) as well as methods aids in pedagogics and psychology.

With a high degree of flying proficiency, these instructors are able to demonstrate in a strict sequence and in detail the procedure for performing all elements of flying and crew members' actions in a difficult situation, and they can conduct a thorough flight critique. They attach great significance to demonstrating the visual aids using slide films, aircraft models, diagrams and posters.

By using a cockpit mock-up, the instructors demonstrate how an aircraft is actually prepared for take-off. Operations from the check list are performed to the full extent by the airship commander and each crew member (copilot, navigator, flight engineer) under the direction of the instructor, operating in conformity with duties prescribed in the Flight Manual.

Primary attention is given to features of taking off in a crosswind (including one of maximum velocity), taking off with limited visibility, and the allocation of functional duties among crew members. When coming in for a landing the instructor gives a reminder of the crew members' duties at the altitude where a decision is made in performing a landing. Special attention is given to the crew members' interworking when going around a second time (including a landing in a crosswind).

In the concluding part of ground training the instructor gives students an assignment to draw in their workbooks diagrams of a flight in a box pattern, flying with loss of engines and flying into a zone. He recommends the use of diagrams and other methods aids for this purpose and tells which literature should be used in preparing for simulator practice.

The important element in the practices is training students to act in special flying situations and developing the crew members' skills of precise work in an emergency: engine failure, fire, flying on back-up instruments, airstart, and so on.

For example, here is how Tu-154 simulator instructor V. M. Gerasimov conducts preflight preparation and training of students in piloting an aircraft using back-up instruments. First of all he finds out which of the students have had instances of failure of the artificial horizon and other flight instruments in flying practice, what indications they used to determine the failure, and the sequence in which they acted in piloting the aircraft with loss of the instruments.

Then the instructor goes on to critique specific incidents of artificial horizon failure from flying practice and dwells in detail on methods for determining this promptly. He directs the students' attention to the difference in determining a rapid and a slow failure. A rapid failure (a "fall") occurs over a 1-2 second period and is determined easily from the rapid changes in instrument readings. But a slow failure, when the build-up in error occurs over several minutes, is not immediately recognized: Here a comparison has to be made of the readings not only of all artificial horizons, but of back-up instruments as well.

The instructor explains in detail that, from the standpoint of flight safety, a failure in between, where the build-up in error occurs over a 10-20 second period, is the most unfavorable artificial horizon failure. Under these conditions a pilot may make steep banks and a considerable change in pitch, and not only a considerable reserve of altitude or time, but also great professional experience will be required to bring the aircraft into horizontal flight. This is why Gerasimov devotes primary attention to practicing flying with an in-between failure of the artificial horizon.

On the initial flight the instructor introduces an artificial horizon failure and warns the student about it. The trainee has to determine the malfunctioning instrument. As a rule, when a slight bank occurs the pilot introduces the opposite bank at the first moment in an attempt to correct the situation. If the student does not cope with the situation and cannot determine the malfunctioning artificial horizon, the instructor himself directs the student's attention to the difference in artificial horizon readings and the aircraft's departure from the course.

When a pitch failure of an artificial horizon is introduced, the instructor recommends that the pilot set the amount of pitch on the artificial horizon in the required position or close to it (for the given flying regime), control the rate of climb within the limits of 10-12 m/sec, monitor the increase in forward speed from the speed indicator, control banks and maintain the necessary power setting. In this sequence it is not difficult for students to determine which of the artificial horizons malfunctioned in pitch. After performing similar "flights," students begin practicing with the introduction of different variants of instrument failure in

different legs of the flight. The factor of surprise is used without fail. When this practice methodology is followed, students usually do not experience great difficulty in determining artificial horizon failures and cope well with aircraft piloting in the situation at hand.

At the end of the practice the instructor holds a critique, giving students an opportunity to analyze their flights themselves. He dwells in detail on characteristic mistakes they have made, explains their causes and gives recommendations for remedying them. He first of all analyzes deviations which occurred in performing those elements of a flight which were to be practiced in the given exercise (he analyzes the most substantial deviations). The instructor records deviations creating an emergency situation in a separate log and gives the students recommendations on remedying these deficiencies, and he recommends methods aids needed in preparing for the next exercise.

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CSO: 1829

AIR

MORE FUEL-EFFICIENT AIRCRAFT ENGINES

Moscow GRAZHDANSKAYA AVIATSIYA in Russian No 12, 1980 p 19

[Article by V. Akimov, professor, doctor of technical sciences: "A Meeting at Your Request: Aviation Energetics of the Future"]

[Text] The Central Institute of Aircraft Engine Construction (TsIAM) imeni P. I. Baranov was organized fifty years ago in December 1930. Formed during the period of our country's industrialization, the TsIAM was at that time the main center of experimental engine construction in the USSR. In particular, the AM-34, the well-known engine of A. A. Mikulin, was completed here. It was installed in the ANT-25 aircraft in which the crews of V. P. Chkalov and M. M. Gromov made the famous flights across the North Pole to America.

With the formation of engine construction OKB [experimental design bureaus], the TsIAM concentrated on research aimed at improving aviation engines and creating a scientific reserve for their development. The Institute played an important role in developing jet technology in the postwar period and in developing theoretical foundations and methods of designing gas-turbine engines and their elements. TsIAM workers took part in creating and finishing many designs along with the OKB collectives.

As a highly skilled science center, the TsIAM works on many problems involved with the development of aircraft engine construction and with prospects for engine evolution in the future. This includes a problem of interest to many of our readers: What will an aircraft engine of the late 20th and early 21st century be like?

The editors asked TsIAM's Deputy Chief, Professor, Doctor of Technical Sciences V. M. Akimov to tell about aviation's energetics problems of today and tomorrow.

The increase in importance of air transportation in solving modern transportation problems makes the power engineering aspects of aviation's development more and more important and acute. On the one hand, demands on the quality and quantity of fuel

are constantly growing in connection with the sophistication of aviation technology and an expansion in the scope of its application. On the other hand, there is a reduction in oil reserves, particularly high-grade oil. In our days scientists around the world are engaged in a search for ways to resolve this contradiction.

A predatory attitude toward natural resources in the capitalist world already has led to serious problems, often termed the "energy crisis." The planned socialist economy makes it possible to ensure the balanced development of aviation technology and fuel production. This development is proceeding along several lines, of which it is possible to identify the three main directions.

First of all, it is an improvement in aviation technology for the purpose of reducing energy expenditures for accomplishing the very same amount of work (an increase in economy). The goal obviously is achieved by improving parameters both of the engines (to reduce specific fuel consumption per unit of developed thrust) and of the flying craft themselves (to improve the load ratio and aerodynamic quality). But the article will examine only matters concerning engines.

Secondly, it is an expansion in production of hydrocarbon fuel.

Thirdly, it is the development of fundamentally new types of energy carriers.

First a word about the possibility of increasing the economy of aircraft engines. Modern by-pass turbojet engines such as the D-36, intended for the Yak-42 aircraft, or the D-30KU, installed in the Il-62M aircraft, have very high operating parameters (gas temperature ahead of the turbines, air pressure ratio in the compressor) and are sufficiently economic for their type. Further improvement can be achieved in the development of new engines with a high by-pass ratio and improved operating parameters. It is true that the creation of this new generation will require a solution to a number of complex problems in the field of gas dynamics and cooling, and development of appropriate materials, technology and structural elements. In particular, the turbine and compressor efficiency (which even now is very high) must be increased even more, aerodynamics of the intake and jet nozzle must be improved, and radial clearances between the rotor and casing in the turbine and the compressor, which have a strong influence on engine efficiency, must be reduced to a minimum. A further reduction of specific fuel consumption of 10-12 percent can be expected as a result. A more substantial increase in the economy of by-pass engines is improbable.

Other opportunities are revealed in evaluating the so-called "propfan" [vintoventilyatornyy] engines, the thrust of which is created by a multiblade, high-rpm, heavy-load propeller (the latter was designated a "propfan"). The efficiency of conventional turboprop engines was degraded with an increase in flight speed greater than Mach 0.7 because of the rapid drop in propeller efficiency. This circumstance was one of the reasons for the shift to by-pass engines with the increase in speed of airliners. But now the attention of designers and scientists is turning again to use of the propeller. Calculations indicate that if a sufficiently high efficiency of the "propfan" can be provided up to speeds of Mach 0.8-0.85, specific fuel consumption will decrease noticeably even in comparison with prospective new generation by-pass engines. It should be noted, however, that in addition to developing an effective "propfan" there must be provisions for minimum losses at

the engine intake, a reduction in noise and vibrations, development of a light reducer for high power and solution of certain other problems.

Moving on to the question of expanding production of hydrocarbon energy sources, we will note that TS-1 aviation kerosene presently is the jet fuel most mass-produced in our country. It is an oil fraction boiled out at a temperature range of approximately 410 to 520 Kelvin. With the existing so-called straight-run technology of production, this fuel can be obtained only from petroleum with a strictly regulated content of harmful impurities, and the corrosive mercaptan sulphur above all.

Petroleum with an increased content of impurities has to be brought in for refining in order to increase the scope of production, and a purification process has to be introduced additionally to the technology to ensure that the product corresponds to demands placed thereon. Industry now is employing the hydropurification of petroleum distillate very familiar in world practice, the essence of which consists of passing hydrogen through it at high temperature and pressure in the presence of a catalyst. Hydrogen reacts with organic impurities containing sulphur, nitrogen and oxygen to form hydrogen sulfide, ammonia and water vapors which are easily removed.

It should be noted that hydropurification not only permits an increase in the production of aviation kerosene, but also improves its quality substantially. Thus the Soviet RT jet fuel produced under this technology possesses greater thermal stability, less corrosiveness and a number of other advantages in comparison with the straight-run fuel. An increase in output of this fuel is an important task for the Soviet petroleum refining industries.

Hydropurification removes only organic impurities of the fuel, and its hydrocarbon composition hardly changes. But an increase in the amount of West Siberian oil, distinguished by a heightened content of aromatic hydrocarbons, in our country's energy balance requires either the use of more complex processes of heavy refining (hydrocracking, hydrodearomatization) or an increase in the permissible content of these substances, which contribute to the formation of carbon deposits and smoke. The first course involves additional heavy capital investments and a certain loss of the petroleum product due to its gasification in the engineering process, and the second course involves increased complexity of aircraft engine combustion chambers. A reasonable compromise obviously has to be found between the two directions.

We will note that with an expansion of the raw material base for the production of jet fuel, a need for compromise solutions also will arise because of the loading of its fractional composition (which will lead to poorer engine starting) and an increase in crystallization temperature (which requires fuel to be preheated on a long flight).

A further increase in production of motor fuel, including jet fuel, will be possible with an even heavier refining of petroleum, capable of removing clear petroleum products from fuel oil.

There is an urgent need to develop and adopt industrial technology for obtaining synthetic motor fuel from pit coal, oil shales and similar raw materials. The fact is that according to present prognoses, world reserves of pit coal and shales will

satisfy man's energy needs for at least another 100-200 years, while petroleum resources will be exhausted in the next few decades. Exploration in this field is being conducted actively both in our country and abroad. The first test models of jet fuel already have been obtained. They are practically of no poorer quality than conventional fuel obtained from petroleum. It is true that the cost of production is still high, but because of the inevitable cost increase of producing petroleum and an improvement in new technology, the production cost of both kinds of fuel may be comparable in the future.

Hydrogen is drawing the fixed attention of scientists in the search for new kinds of energy carriers. Its reserves are truly inexhaustible, for it is a component of water. The opinion exists that the future of power engineering in general (and not just aviation power engineering) is connected specifically with the use of hydrogen.

The cost of producing hydrogen substantially exceeds for now the cost of aviation kerosene. But it is apparent from forecasts that the price of petroleum products will steadily rise, while that of hydrogen will drop as the technology of water electrolysis using nuclear (and subsequently even thermonuclear) energy is mastered. It is expected that the cost of a thermal unit of both kinds of fuel will be equivalent approximately by the end of this century.

Hydrogen has a significant energy advantage over hydrocarbon fuel: In comparison with kerosene it has 2.8 times greater calorific power, which means an approximately proportionate reduction in specific fuel consumption. At the same time, hydrogen requires 15 times less energy for its combustion.

The high cold resource of liquid hydrogen (most suitable for practical use) provides an effective removal of heat from engine and aircraft elements. This promises an opportunity for an additional increase in flight speed and an improvement in engine parameters through an increase in maximum temperature of the cycle.

A shift to hydrogen fuel will have a beneficial effect on the solution of ecological problems, which is of no small importance. As a matter of fact, when it burns in an atmosphere of oxygen, the only reaction product is water, which returns fully to nature's cycle and carries no harmful impurities. It is true that under certain conditions the oxidation of hydrogen in the air may incidentally cause the formation of nitrogen oxides, but in substantially less quantities than with the combustion of gasoline or kerosene.

There also are certain deficiencies inherent in the prospective kind of fuel which place unique demands on the design of fuel tanks and engines. The density of hydrogen is approximately 11 times less than kerosene, forcing the use of tanks of larger capacity. Due to its low boiling temperature (20 K), the transportation and storage of hydrogen requires effective heat insulation of tanks, pipelines and other elements, otherwise the evaporation losses may be high. To reduce these losses and increase the cold resource, the use of preliminary supercooling is possible. For example, use of a "sludge" consisting of half solid (below 14 K) and half liquid hydrogen theoretically will permit a reduction in loss and allow a decrease in pressure in the tanks with a simultaneous increase of fuel density by 12 percent. A certain deterioration of properties of structural materials with such low temperatures and an increased complexity of the fuel supply system because of a need for preliminary cooling of its elements should be noted in passing.

But it is clear even now that all these deficiencies cannot create fundamental obstacles to the use of hydrogen in aircraft engines.

An interesting relationship has been established: The higher an aircraft's speed and weight, the more expedient is the use of hydrogen engines. And at speeds beginning at Mach 6-7, hydrogen becomes the only suitable kind of fuel for air-breathing engines.

Use of the new fuel on a broad scale will require above all assurance of a suitable transportation cost (in connection with high initial expenditures) and an acceptable loss of capital investments in airport ground complexes including arrangements for liquefaction, storage and transportation of hydrogen. Nevertheless, specialists view the possibility of using hydrogen in experimental aircraft of civil aviation as early as the late 1980's and beginning of the 1990's.

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CSO: 1829

UDC 658.012.65:629.113.002:656.13

MOSCOW AUTOMOTIVE PLANT IMENI LIKHACHEV SEEKS IMPROVED VEHICLES

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 12, 1980 pp 4-6

[Article by Doctors of Technical Sciences A. M. Kriger and A. G. Zarubin, ZIL Production Association: "Strengthening Ties between Automotive Industry Enterprises and Vehicle Transportation Enterprises Is a Crucial Condition for Improving the Reliability and Economy of Motor Vehicles"]

[Text] The ZIL [Moscow Automotive Plant imeni I. A. Likhachev] Production Association is constantly studying questions of controlling the quality of the motor vehicles it produces. They have always done this work in close contact with the organizations and departments that use ZIL vehicles: reference motor pools directly linked to the plant, the ministries of motor vehicle transportation of the RSFSR and the Ukraine, their scientific organizations (NIIAT [State Scientific Research Institute of Automobile Transportation], GosavtotransNIIproyekt [possibly State Scientific Research and Planning Institute of Motor Vehicle Transportation], and Glavmosavtotrans [Main Administration of Motor Vehicle Transportation in Moscow] and with the scientific research institute the administration established at the end of the last decade , the scientific organizations of the USSR Ministry of Automotive Industry (NAMI [State Scientific Research Institute of Automobiles and Automobile Engines], NIIavtopriborov [Scientific Research and Experimental Institute of Automobile and Tractor Electrical Equipment, Carburetors, and Instruments], NIIPP [possibly Scientific Research Institute of Polymerization Plastics], and others), and certain higher educational institutions (MADI [Moscow Highway Institute], MAMI [Moscow Institute of Automotive Engineering]).

An enormous amount of work has been done, and it would be impossible to list all the design and technological improvements in the ZIL vehicles made by the plant in the last 10 years. Therefore, we will refer only to the main ones.

For the engine — reliability has been improved; the working life has been increased (distance until capital repair from 18,000 to 250,000 kilometers); alterations of the fuel system were made to reduce the specific expenditure of fuel.

For the transmission — more reliable roller bearings were introduced; synchronizing devices were improved; locks were introduced to prevent slipping out of second and fourth gears when being towed and pulled. These things made it

possible to increase the working life of transmissions to 300,000-350,000 kilometers before capital repair.

For the propeller shaft — the design of the joints, packing of working surfaces, and cross-pieces was modified; a new grade of steel was used; needle bearings with smaller clearances between needles were introduced; liquid lubrication of the joints was replaced by greasing. As a result of these measures the working life of the propeller shaft was increased to 300,000 kilometers and it is able to operate without lubrication during the process of use.

For the drive axles — the brace of the drive axles is manufactured from 17GS steel; a procedure was introduced for hardening it by creating compressive stresses in the lower half of the housing, tempering it by heating with high-frequency current and tempering the journal pins of the housing; reinforced bearings were used; since 1978 many of the vehicles produced have been equipped with hypoid axles of improved reliability; the working life of double-reduction axles was increased to 300,000 kilometers, while for hypoid axles it is 500,000 kilometers.

For steering — the steering mechanism has been modernized by increasing the diameter of the steering arm shaft and strengthening its gear teeth; the working life of the pump of the hydraulic power steering unit has been increased by introducing a discontinuous groove in the housing and by using a new, more efficient curved shape for the pump stator.

For the electrical system — contact-transistor ignition, and AC current generator with a block of silicon rectification diodes and voltage regulator, a more powerful starter, blinking turn signals, and noise suppression devices in all high-voltage lines have been introduced.

All of these measures have enabled the plant to carry out the orders of the 24th and 25th CPSU congresses, significantly improve the reliability of particular assemblies and aggregates and, therefore, of the ZIL-130 vehicles, raise their service life before capital repair from 175,000 to 300,000 kilometers, improve the productivity of these vehicles by increasing their load capacity from five to six tons, reduce linear norms of fuel expenditure, and reduce the amount of ongoing repair work.

Long years of cooperation among ZIL, Glavmosavtotrans, NAMI, and MADI, which has been supported by most of the plants in the sector, provided the starting point for the mass movement of "300,000-kilometer" drivers. These are drivers who try to take their vehicles 300,000 kilometers before capital repair and to use fewer spare parts than envisioned by norms. This movement demonstrated that when both the plant and the operations organizations fulfill the obligations they have undertaken it is possible not only to match established norms for working life, but even to surpass them.

The collectives of Glavmosavmosavtotrans, ZIL, NAMI, and MADI obligated themselves to perform a set of jobs to increase the working life of ZIL-130 vehicles before capital repair to 350,000 kilometers and to reduce the labor-intensiveness of technical maintenance on the vehicles by 10 percent

compared to the norm. The first year of the new decade is demonstrating already that this challenge will be met.

This places new, more complex problems before the participants. Among these problems are continuing design and technological refinement of the vehicles, updating various statutes adopted earlier, and revising some outdated concepts, correcting them to reflect the new, higher quality of motor vehicles produced in 1980 and subsequent years. The time has come to put an end to those forms and methods of operating and repairing transportation motor vehicles that lead to inefficient expenditure of money, materials, and labor. Therefore, the 1980's should see new advances by the automotive industry and motor vehicle transportation.

The plant began producing the ZIL-130-80 vehicle in 1980. It has an engine with a longer working life and improved fuel economy. The guarantee period for these vehicles has been increased to 30,000 kilometers and it is recommended that the servicing schedules be increased to every 4,000 kilometers for No 1 servicing and 12,000 kilometers for No 2 servicing in order to reduce the labor-intensiveness of technical maintenance.

In the next five years the following developments are contemplated for further improvement in the design of the vehicles being produced.

1. An increase in the working life of the engine to 300,000-350,000 kilometers by improving the filtration of intake air, fuel, and motor oil; improving the reliability of individual parts by heat-chemical treatment; hardening the working surfaces of parts by applying low-wear layers of coating and using laser treatment, and others.

2. Improving the fuel economy of engines by making a number of design changes, above all, introducing the injection spray process of burning fuel in the engine.

3. Raising the indicator of load capacity of truck beds by increasing the production of long-frame ZIL-130G vehicles equipped with large-capacity beds.

4. Increasing the proportion of vehicles produced with hypoid axles.

Summarizing, we can conclude that the ZIL Production Association increases reliability, economy, and other operating indicators of the vehicles it produces year after year and plans to continue this work. All this applies chiefly to new vehicles and aggregates that have not undergone capital repair. The country's vehicle fleet, however, consists chiefly of vehicles that have gone through complete or partial overhaul at one or several repair plants, and sometimes in the workshops of motor vehicle transportation enterprises. As a result, the quality of repair and working life of repaired assemblies are lower than for new ones. This is because of inadequate organization of vehicle repair work, in particular the lack of full standardization of requirements for the qualitative characteristics of vehicles coming into repair and leaving repair. The GOST [State All-Union Standard] 18505-73 and GOST 18506-73 which were published in 1973 as well as the 1977 amendments to them did not relate to many motor vehicles that are received at repair enterprises and did not concern component units of vehicles at all. The

Technical Specifications TU-200-RSFSR 2/1 2050-77 published by the Ministry of Motor Vehicle Transportation contained a category called restorative repair, but do not stipulate requirements for working life after the repair. As a result of this authorization, restorative repair proved most acceptable to repair plants and began to be introduced practically everywhere (according to information from NAMI and ZIL more than 95 percent of the output of vehicle repair plants today comes after restorative repair and no more than five percent after capital repair). As a result, the working life of repaired vehicles is often not 80 percent of the life envisioned for new vehicles as GOST 22581-77 requires, but rather much less.

This practice necessitates repeated repair work, which of course involves heavy use of spare parts and an increase in the prime cost of repair. During repair work few worn out parts are restored because the cost of new parts is often lower than the cost of restoring old parts.

Aware of the low quality of vehicle repair, many motor vehicle enterprises operate vehicles without sending them to the repair plants and repair them themselves. This becomes possible, if for no other reason, because the products list of spare parts that trade organizations can demand includes important automotive parts. Therefore, component automotive units can be assembled from spare parts during repair. What is more, GOST 18322-78, which defines the concept of capital repair, envisions the possibility of replacing any parts, including basic parts.

New directive norms and schedules should make it possible to control the quality of motor vehicle operation in an organized manner, set up production correctly, and determine the rational volume of spare part production. An amendment to GOST 1337-75 that defines working life more precisely would help in this.

GOST 13377-75 says that working life is "the amount of work done by a unit from the beginning of its use or restoration until it reaches its limiting state." But any specialist knows that it is easy to insure the assigned working life with the level of mutual replaceability of parts adopted in the automotive industry if we do not consider the spare parts used for this purpose. When the drivers of Glavmosavtotrans began competition to drive ZIL-130's 300,000 kilometers, they were given a maximum total value for spare parts that could be used during this time. This makes the competition purposeful. It makes it possible to determine who has operated motor vehicles in what way, and permits economizing on spare parts. If we determine the number of spare parts needed for the entire cycle before capital repair and establish the number of needed spare parts for repair with a limited number of repeated repair jobs, we can identify the need for spare parts for the entire working life of the vehicle quite accurately. When this quantity is distributed appropriately over the years of the normative working life of the vehicle, it is possible to identify the average annual need for spare parts. This norm should be compulsory both for manufacturers and customers. Therefore, the amendment to GOST 1337-55 could be worded roughly as follows: "Working life is a technical-economic category, and for motor vehicles it is characterized not only by number of kilometers driven but also by the use of spare parts for this driving expressed in rubles for the entire working life or per 1,000 kilometers of driving."

The combined efforts of specialists in industry and transportation will make it possible to find ways to solve these problems quickly and thus make a major contribution to the questions of quality control. This will permit us to have an enormous national economic impact.

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CSO:1829

MOTOR VEHICLE

MOTOR VEHICLE EXPORTS TO CEMA COUNTRIES

Moscow ZA RULEM in Russian No 11, Nov 80 p 8

[Article by L. Gavrilov, deputy general director of the Avtoeksport All-Union Association: "Automotive Integration"]

[Text] A majority of the Soviet Union's national economic sectors are closely linked with the corresponding sectors in the fraternal socialist countries. The automotive industry occupies an important place in this ever-intensifying integration. Mutually advantageous relations are being established here for extended periods. This makes it possible to plan the development of production capacities considering perspectives and fully to use the advantages of long-term cooperation.

We consider 1947, when the Gor'kiy Automobile Plant [GAZ] shipped the first consignment of Pobeda cars to Hungary (prior to that there had been insignificant deliveries of our vehicles in the late 1930's), as the beginning of the export of cars from the USSR. They quickly won authority among foreign buyers, especially among Scandanavian taxi drivers. Export of the Moskvich (Model 401) began in 1949, followed by the Zaporozhets. Since then approximately 1.2 million Moskvich cars in 19 models have been shipped to 78 countries. Car exports from the USSR rose especially noticeably after the Volga Automobile Plant [VAZ] went into operation.

Today there are 8 cars in more than 30 modifications in our association's export program. They are encountered on the highways of almost 80 states on all continents. About 2.5 million Soviet cars have been purchased in various countries. The Lada (Zhiguli), Moskvich, Volga, and Zaporozhets form the foundation of Bulgaria's car fleet and make up a large percentage of the fleet in the GDR [German Democratic Republic], Hungary, Poland, Czechoslovakia, Mongolia, Cuba, and Yugoslavia. Foreign trade organizations in these countries—Avtoimpex (Bulgarian People's Republic—BPR), Mogyurt (Hungarian People's Republic—HPR), Transportmaschinen (GDR), Transimport (Cuba), Pol'-Mot (Polish People's Republic—PPR), Motokov (Czechoslovakian Socialist Republic—CSSR), and Progress and Tsrvena Zastava (Socialist Federated Republic of Yugoslavia), being the main importers of Soviet automotive technology, annually purchase tens of thousands of vehicles from Avtoeksport. These cars are valued for their reliability, durability, and longevity. Growing interest in Soviet vehicles also is apparent from the expansion in the geography of export deliveries. Just recently Ladas appeared on the highways of New Zealand, Canada, Singapore, and Malaysia.

Auto-making products are the most dynamic group in our commodity turnover with CEMA countries. The annual growth of mutual vehicle and equipment deliveries is based here primarily on profound and stable production specialization and cooperation. Today the USSR exports to the socialist countries not only motor vehicles, but a wide gamut of individual items, assemblies and components.

Avtoeksport's first operations in this field date back to 1968, when the association exported components. Even before that, batteries and individual parts for trucks were purchased in the BPR for our automobile plants. Recently, mutual exchanges between the USSR and the other fraternal socialist countries have increased. As early as 1971-1975 they made up 9.1 percent of Avtoeksport's commodity turnover and they were even more during this five-year plan. Thus, they were about 14.3 percent of commodity turnover in 1978. The association's export program this year already included 108 different components, assemblies, and items manufactured by 38 of our plants, whereas the import program involved 200 for Soviet automotive enterprises.

Purchase volume rose noticeably after the Volga Automobile Plant and Kama Automobile Plant [KamAZ] went into operation. Plants and foreign trade organizations in the socialist countries are the basic suppliers of articles for Lada and KamAZ vehicles. Cooperative ties support BelAZ [Belorussian Automobile Plant], the AZLK, LiAZ [Linkino Automobile Plant], and LAZ [L'vov Automobile Plant], as well as VAZ and KamAZ.

What do we receive from our friendly partners and what do we supply them?

The BPR makes storage batteries, starters, ac generators, and a number of other items for the Volga Automobile Plant. The payment for import is in completed vehicles. Overall for the five-year plan the VAZ will receive components worth R122.2 million from the BPR.

On their part, Bulgarian organizations are buying forklift engines, steering mechanisms, clutch plates, and other items and components--13 different ones in all--from Avtoeksport. Delivery of microbus components (transmissions, springs, clutches, steering mechanisms, 55 different ones in all) also has been in progress since 1979. The sum of all these deliveries for the 1976-1980 five-year plan will be R21.4 million.

HPR. Since 1969 Lada components have been built here. In 1975 some 19 different component types already were being supplied to Tol'yatti. During this five-year plan VAZ is receiving windshield wipers, ignition distributers, horns, dashboards, and other items worth R354.8 million. We cooperate with the HPR in production not only of cars, but buses as well. The popular Ikarus buses are an example of the cooperation of several CEMA countries. Automatic transmissions are sent to Hungary from the CSSR, windshield wipers with motors from the PPR, and seats from the GDR. Front axles, hydraulic steering booster pumps, and hydromechanical transmissions for Ikarus buses are made in the USSR. During 1975-1980 Avtoeksport will supply Hungary's bus industry R67.8 million worth of items and assemblies. In turn Hungarian rear axles and hydromechanical transmission components will be supplied for Soviet buses.

The GDR supplies VAZ horns, spark plugs, and optical elements, plus a whole line of articles, including rectangular lights and hydraulic jacks for dump trucks to our other plants.

The PPR sells us 19 different items and components for building the Lada. In turn, we supply 16 items for the Pol'skiy Fiat-125. In 1975 (the first section of the KamAZ had been completed by then) a governmental agreement on production collaboration and cooperation was signed envisaging Poland supplying the USSR components for KamAZ vehicles and completed trucks being supplied in return. By 1976 the plant in Naberezhnyye Chelny began to receive Polish brakes and key-actuated switches.

The CSSR produces four types of Lada units and components, primarily lighting devices, as well as running lights and headlights for KamAZ vehicles.

Yugoslavia. Storage batteries, steering wheels, rear view mirrors, facing components, filter elements, and other Yugoslavian-produced articles are used on VAZ assembly lines. In return Tsrvena Zastava buys Ladas from us. Between 1969-1975 Yugoslavian export for VAZ was worth R44.4 million. Since 1976 we have been receiving electric motors, fog lights, and brake lights for KamAZ vehicles. During the five-year plan coming to an end the export of VAZ and KamAZ components will rise to R214.6 million.

Avtoeksport buys certain components and units from firms in other countries for the cars supplied in our country, where the market is distinguished for its specific requirements.

The rapid growth of auto-making products in the USSR and other socialist states creates the prerequisites for intensifying production specialization and cooperation in auto-making and for an increase in mutual deliveries. At the same time intensified integration facilitates their development and increased product quality. Envisioned in the 1981-1985 plans was a significant rise in mutual deliveries of automotive equipment and an increase in the products list. Taken into account here is the anticipated replacement of models, which will occur in the near years. Overall auto-making remains the sector where socialist integration comes to the fore. According to the 23 September 1971 Agreement on Multilateral International Specialization and Cooperation in Product Manufacture in the Automotive Industry, the USSR and CSSR have taken up production of heavy vehicles. Here, the Tatra Plant (in Koprivnica) is expanding and being renovated from funds borrowed from the International Investment Bank. The plant's production capacity will reach 15,000 trucks per year when the construction is finished.

Soviet vehicles, like those from the socialist countries, more widely are entering world markets.

Consistent development of production specialization and cooperation on a long-term basis is one of the important conditions for our economic successes. This work remains the main trend in increasing the effectiveness of further collaboration of the CEMA countries for the forthcoming decade as well. As was noted during the 34th CEMA Conference, held in Prague this summer, the rates of growth in the national income and industrial production in the CEMA countries during 1971-1979 were approximately double those of the developed capitalist states. The Prague Conference noted the new perspectives for economic coordination among the socialist countries.

We have a great goal and a clear reference point in all this work, which has far exceeded purely economic bounds. They were formulated in a June CPSU Central Committee Plenum decree: "Further intensification of the collaboration of the countries of socialism in political, economic, defense, and other spheres and the constructive activities of their joint organizations--the Warsaw Pact and the Council of Economic Mutual Assistance--reliably serve the cause of peace and progress."

7869
CSO: 1829

UDC 658.012.65:629.113.002

GOR'KIY AUTOMOTIVE PLANT STUDIES USE OF ITS PRODUCTS

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 12, 1980 pp 3-4

[Article by A. D. Prosvirnin, Gor'kiy Automotive Plant Production Association: "Creative Cooperation among Science, Production, and Users"]

[Text] The Gor'kiy Automotive Plant has been working on a planned basis to expand cooperation with operations organizations (motor vehicle transportation enterprises) and vehicle transport scientific research institutes to study the operating reliability of GAZ vehicles since 1959. Steps taken to build vehicles which meet current technical and economic requirements have the maximum impact only when the efforts of science, production, and practical use are combined.

The chief aim of this cooperation is to establish two-way communication between production and operations so that production, on the basis of thorough study of the level of reliability achieved by its vehicles and the operating factors that influence this level, can develop and introduce steps to improve the technical and operating indicators and reliability of these vehicles. Under these conditions operations workers are able to have a greater influence on building vehicles with the best qualitative indicators for introducing progressive methods of maintenance and repair and raising the general level of technical operation of motor vehicles. The final result of joint efforts is to supply the country's fleet of motor vehicles with more efficient machines.

The development of cooperation between the Gor'kiy Automotive Plant and operations organizations can be provisionally broken down into three stages. In the first stage, 1955-1964, communication took the form of one-time surveys of various motor vehicle transportation enterprises, conducting talks with engineering-technical personnel, drivers, and repair workers at the enterprises, and sending out questionnaires to remote enterprises concerning the working conditions of GAZ vehicles and their quality and reliability. Naturally, using this technique to obtain information on the operating reliability of the vehicles made the information random, and often subjective and contradictory. This made it more difficult to analyze the data and make decisions, so it became necessary to find new principles of organizing communications with the operations sphere.

In 1964 joint work was begun to study the reliability of the vehicles and engines, increase the working life of the vehicles, and reduce the use of spare parts. Cooperation between the Gor'kiy Automotive Plant and operations workers rose to a qualitatively new level.

A system of reference motor pools was established. They were located in different climatic zones and covered practically the full range of road conditions. The plant concluded contracts with these motor pools to conduct joint studies of the operating reliability of GAZ vehicles. These contracts were usually ratified by the oblast motor vehicle transportation administrations who managed the reference motor pools. Under these contracts the plant provides the motor pools with methodological guidance, technical consultation on questions of using GAZ vehicles, and spare parts for intensive use of batches of test vehicles. The reference motor pools formed groups, and also reliability laboratories in some cases, to insure the collection of complete, reliable, and continuous data on the working condition of the test vehicles, malfunctions and breakdowns, methods of fixing them, and actual use of spare parts. Further experience confirmed the vitality of this system, and the network of reference motor vehicle enterprises established in 1964-1968 continues to work successfully today. The number of test vehicles (498 in 1970 and 1,181 in 1980) and improved parts (2,100 in 1970 and 5,100 in 1980) being introduced in production increases each year.

At the same time as it was setting up and developing the system of reference motor pools, the Gor'kiy plant was searching for progressive ways to organize the collection, handling, and processing of information on the operating reliability of the vehicles. For example, the plant takes an active part in the work of the intersectorial commission on questions of reliability of machine building parts which was set up in 1968 at the initiative of the Ministry of Automotive Industry. The plant has co-authored most of the sectorial and intersectorial technical guidelines and standards on questions of the reliability of automotive parts.

The work of the commission on reliability led to determination of the basic principles and directions of joint work by production and operations in the field of studying and improving the operating reliability of vehicles, the adoption of a methodology for organizing the collection of information on reliability taking account of the interest of production and operations, and the development of methodologies for processing information with contemporary computers. In other words, the scientific methods foundation was laid for continued joint work, and this foundation is still used today. It is plain that the successful work of the intersectorial commission resulted from combining the efforts of the leading automotive plants, the Gor'kiy Automotive Plant and the Moscow Automotive Plant imeni I. A. Likhachev, and the head scientific research organizations in the field of motor vehicle transportation and higher educational institutions.

This was also the time when close cooperation began between the Gor'kiy plant and the scientific research organizations of motor vehicle transportation and industry. Operations testing of GAZ vehicles was organized jointly with NAMI [Central Scientific Research Institute of Automobiles and Automobile Engines], NIIAT [State Scientific Research Institute of Motor Vehicle

Transportation], and GosavtotransNIIproyekt [possibly State Scientific Research and Planning Institute of Motor Vehicle Transportation] of the Ukrainian SSR. The Gor'kiy plant's cooperation with GosavtotransNIIproyekt was especially fruitful. They organized the testing of GAZ-53A vehicles in vehicle enterprises of Odessa and Kiev in 1968 and have continued this work without interruption since then. Several shipments of vehicles produced in different years have been tested, producing a large volume of information on changes over time in the operating reliability of the vehicles and the effectiveness of design and production engineering steps introduced by the plant. The experience of cooperation with GosavtotransNIIpropyekt helped considerably in streamlining the system for organization of collection of raw data on the reliability of vehicles and putting the data in a form appropriate for computer processing.

The tests of GAZ-53A vehicles in vehicle column No 1518 in Kumertau are an example of effective cooperation between the plant and NIIAT. These tests confirmed the feasibility of increasing the time between scheduled repairs for the vehicle without reducing its reliability indicators. This provided the basis for correcting the norm part of the "Statute on Technical Servicing and Repair of Motor Vehicles Used in Transportation."

The complete and reliable information received by the plant as the result of joint operations testing and the objective assessments of reliability given by the operations organizations enabled the plant to develop and introduce a program of design and production engineering measures for the parts and assemblies that were limiting the reliability of the vehicle and its elements.

Thus, between 1967 and 1972 more than 30 major steps were introduced for the GAZ-53A alone. This made it possible to increase the working life of the vehicle to 200,000 kilometers and get it certified for the state Mark of Quality in 1973. Tests made jointly with NIIAT in vehicle column No 1158 [sic] in Kumertau in 1974 demonstrated the feasibility of increasing the working life of the GAZ-53A even further, to 250,000 kilometers. This was accomplished in 1979.

A new stage in cooperation between the Gor'kiy Automotive Plant and operations organizations began in 1973-1975. The distinctive feature of this phase is that joint work encompasses all elements of both the production and use of vehicles, including the automotive plants, scientific research organizations, and vehicle repair enterprises. This was not the case earlier.

Socialist contracts on scientific-technical cooperation among the collectives of the Gor'kiy Plant, the Volga Engine Plant imeni 50-Letiya SSSR, the republic ministries of motor vehicle transportation, and NAMI provide the foundation for joint projects. The plant has concluded such contracts with the ministries of motor vehicle transportation of the RSFSR, Ukraine, and Uzbekistan and with the Main Administration of Motor Vehicle Transportation in Moscow of the Moscow City Executive Committee.

Within the framework of these contracts the Gor'kiy Automotive Plant is conducting operations testing of 600 GAZ-53A and GAZ-52-04 vehicles, 450 GAZ-24-01 vehicles, 130 GAZ-66 vehicles, and 5,000 experimental parts, assemblies, and aggregates at its reference motor pools.

This broad study of the reliability of motor vehicles under actual operating conditions and the information that it produced enabled the Gor'kiy Automotive Plant to develop and introduce various design and production measures that increased the working life of vehicles before capital repair (from 100,000 to 150,000 kilometers for the GAZ-66, from 250,000 to 350,000 kilometers for the GAZ-24-01, and from 120,000 to 250,000 kilometers for the GAZ-53A), to reduce the normative spare parts requirement by an average of 15 percent, and thus to win, and retain more than once, the state Mark of Quality for the GAZ-66, GAZ-24-01, and GAZ-53A vehicles.

The Gor'kiy plant has set its goal as insuring high operating reliability both in the period before capital repair and for the entire working life of the vehicle. On the basis of studying contemporary domestic and foreign experience in vehicle repair the plant is working out design and technological documents for capital repair of vehicles and their aggregates, assemblies, and parts. They contemplate a technology that will permit parts to be restored by industrial methods and give the repaired parts a working life of at least 80 percent of the working life of new parts.

The collectives of the Gor'kiy Automotive Plant, ZMZ [Transcaucasian Metallurgical Plant or Zlatoust Metallurgical Plant], the Main Administration of Motor Vehicle Transportation in Moscow, the Moscow Highway Institute, NAMI, and the Gor'kiy Polytechnic Institute have signed an agreement on socialist competition and cooperation which is a new step in work to improve the quality, reliability, and efficiency of use of GAZ trucks. The contract contemplates a further increase in the reliability of GAZ-53A and GAZ-52 vehicles, study of the actual level of reliability of low-toxicity gas cannister GAZ trucks in the specific operating conditions of the city of Moscow, an increase in the technical-economic indicators of operations, and an improvement in the quality of capital repair of vehicles.

The Gor'kiy plant considers its next challenge in broadening its cooperation with the operations sphere to be organizing a system of reference points in agriculture, which is the chief customer for GAZ trucks. They have already taken the first steps in this direction by organizing test operations of vehicles at three large sovkhozes in Gor'kovskaya Oblast. A program has been worked out and put into effect to study the specific operating factors that influence the reliability of the vehicles under actual agricultural conditions and the suitability of GAZ vehicles to the production processes in agriculture.

The plan for the near future envisions organizing cooperation with the Ministry of Agriculture to improve the design of GAZ trucks to a level that insures maximum efficiency in their operation.

11,176
CSO: 1829

UDC 621.43.068.4:629.114.6

NEW ANTIPOLLUTION DEVICES PLANNED TO REDUCE AUTO EMISSIONS

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 12, 1980 pp 6-7

[Article by Candidate of Technical Sciences Ye. V. Shatrov, V. M. Varyugin, Candidate of Technical Sciences A. F. Dmitriyevskiy, and Candidate of Technical Sciences B. A. Kurov, State Scientific Research Institute of Automobiles and Automobile Engines: "Prospects for Reducing the Toxicity of Cars"]

[Text] The level of concentration of harmful substances in motor vehicle exhaust gases is determined by the norms of national standards.

In the United States in 1980, for example, the effective norms were established in 1975. Until October 1979 the Western European countries used norms established by the U. N. European Economic Commission in 1975; in October 1979 new norms were adopted by the EEC for the period from October 1979 until October 1983.

These norms differ (see Table 1 below). They are most rigorous in the United States, Japan, and Sweden, whereas in the Common Market countries of Europe they are less strict.

In the USSR legislation to limit emissions of carbon monoxide on idle was introduced in 1971 (GOST [State All-Union Standard] 16533-70). In 1975 controls were instituted on emission of CO, CH, and NO_x with tests of specially prepared vehicles and series-produced vehicles using the European driving cycle (OST 37.001.054-74). The standards envisioned a tightening of the norms by stages, so that the permissible CO emission on idle in 1980 was set at one-third of the 1971 level, and for tests using the driving cycle the emission of toxic substances in 1980 compared to 1975 was lowered by 45 percent for CO and 20 percent for CH. If these norms are compared with the norms established and operative in most Western European countries and with Rule No 15 of the U. N. European Economic Commission, we find that they are much more rigorous (seven percent for oxides of nitrogen and 23 percent for carbon monoxide).

Further tightening of the norms for permissible emissions of toxic substances by motor vehicles are envisioned. Thus, in 1985 plans call for reducing the emission of CO to one-third of the 1975 level, by one-half for CH and by one-third for NO_x. This tightening of the norms for emissions of toxic substances necessitated work to select a set of antipollution devices for each

Table 1

(a)	(b)	(c) 1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	(d)
(USSR)	CO CH NO_x	[illegible] [illegible] —	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	(EEC)
(EEC)	CO CH NO_x	[illegible] [illegible] —	[illegible] [illegible] —	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	— — —	— — —	— — —	(EEC)
(Sweden)	CO CH NO_x	[illegible] [illegible] —	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	— — —	— — —	— — —	— — —	— — —	FTP-[illegible]
(e)	CO CH NO_x	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	FTP-75
(f)	CO CH NO_x	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	— — —	— — —	— — —	— — —	FTP-75
(Japan)	CO CH NO_x	— — —	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	— — —	— — —	— — —	— — —	(Japanese)

Note: USSR and EEC norms given for specially prepared vehicles.

Key:
- (a) Country (Regulations);
- (b) Toxic Substances;
- (c) Norms for Emission of Toxic Substances in Grams per Kilometer, by years;
- (d) Test Cycle;
- (e) United States, without California;
- (f) United States, state of California.

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model of domestic motor vehicle with a full weight of less than 3,500 kilograms.

At the present time we have engineering concepts that make it possible to meet the norms of any existing standard without a radical change in the design of series-produced engines. This is accomplished by rational and economically justified selection of a set of antitoxic devices: carburetors that reduce the toxicity of exhaust gases; systems that automatically warm air at the inlet to the carburetor; systems that recirculate exhaust gases; systems to trap fuel vapors; systems that neutralize exhaust gases.

A set of antipollution devices that will meet the norms for emission of toxic substances in 1981 and 1985 while maintaining, and in certain cases even improving, fuel economy has been selected as the result of research, design, and adjustment to work done by NAMI [State Scientific Research Institute

of Automobiles and Automobile Engines] together with plants and scientific research institutes of the sector.

Thus, the emission of toxic substances by vehicles with a full weight of 1,020-1,250 kilograms and a working engine volume of $1.2-1.5 \times 10^{-3}$ cubic meters meets the norms which are to be introduced on 1 January 1981 when these vehicles are equipped with Ozon carburetors with a modified ratio of dimensions between the primary and secondary mixing chambers. This carburetor contains an autonomous idling system, an electromagnetic valve to switch off fuel on forced idling, an automatic starting and warming device, a pneumatic drive choke for the secondary chamber, and a distributor with a centrifugal-vacuum automatic spark advance device. Tests showed that the antipollution devices reduced CO emissions by more than one-half compared to 1975, lowered CH emissions by one-third, and NO_x emissions are no more than 7-8 g/stp [grams per standard test phase]. Moreover, the fuel consumption for city driving decreases almost seven percent.

Table 2 below gives figures on the emission of harmful substances in g/stp for motor vehicles with a full weight of 1,020-1,250 kilograms and different sets of antipollution devices.

Table 2

Sets of Vehicle Antipollution Devices	Emission of Toxic Substances in g/stp		
	CO	CH	NO_x
Without Antipollution Devices (Produced Before 1975)	150-200	10.0-14.0	8-10
With Modernized Carburetor (1975-77 Production)	100-120	8.0-10.2	6-8
With Ozon Carburetor Equipped with Autonomous Idling System (AIS) and Pneumatic Drive Throttle of Secondary Chamber (PNT2C)	45-79	5.1-7.2	6-7.7
With Ozon Carburetor with AIS, PDT2C, and Centrifugal-Vacuum Automatic Spark Advance Unit (CVASAU)	40-76	5.3-7.4	6.5-8.2
With Ozon Carburetor Equipped with AIS, PDT2C, Electromagnetic Fuel Shutoff Valve (EFSV), Automatic Air Warmer (AAW), and CVASAU	25-52	4.2-6.0	5.0-8.1
With Ozon Carburetor Equipped with AIS, PDT2C, EFSV, AAW, Exhaust Gas Recirculation System (EGRS), and CVASAU	22-54	4.5-6.2	2.8-4.5

When the systems for recirculation of exhaust gases and warming air at the intake of the carburetor are installed the Swedish toxicity norms are met also. A motor vehicle equipped with this set of antipollution devices lowers emissions of toxic substances compared to vehicles without such devices by almost two-thirds for carbon monoxide, one-half for hydrocarbons, and one-third for nitrogen oxides while cutting fuel consumption by two percent. A vehicle which additionally is equipped with an exhaust gas neutralization system (EGNS) with a two-component neutralizer and a system to trap fuel vapors (STFV) also meets U. S. standards. Motor vehicles equipped with this set of antipollution devices emit far fewer toxic substances than vehicles without the devices: one-eighth as much CO, one-seventh as much CH, and about one-fourth as much NO_x. But this significant reduction in toxic emissions is not accomplished without an increase in fuel consumption.

To satisfy norms set for 1981, therefore, Zhiguli and Moskvich-2140 cars must be equipped with the Ozon carburetor with AIS, EFSV, PDT2C, and automatic starting and warming (ASaW). The norms contemplated for 1985 can be met using the Ozon carburetor (fully equipped), CVASAU, STFV, AAW, and EGRS. Fuel consumption with this set of antipollution devices matches the level of consumption for a series-produced vehicle.

The emissions of vehicles with a check weight of 1,470-1,700 kilograms and a working engine volume of $2.5 \cdot 10^{-3}$ cubic meters (the GAZ-24 Volga and UAZ) meet the norms of the operative 1980 standard with installation of a K-151 or Ozon carburetor with AIS, EFSV, AS, PDT2C, AAW, and EGRS. The norms contemplated for 1985 will be met by these vehicles using a fully equipped K-151 or Ozon carburetor, EGRS, STFV, and AAW (see Table 3 below).

Table 3

Antipollution Devices of Carburetors	Emission of Toxic Substances in g/stp CO	CH	NO_x
K-129	134	10.3	14.0
K-131 (with AIS and EFSV)	73	8.5	14.0
DAAZ (with AIS and EFSV)	50-70	8.5-9.0	13.5-14.0
DAAZ (with AIS and EFSV) and EGRS	70	12.8	8.3-11.5

If an exhaust gas neutralization system is also installed in these vehicles the emission of carbon monoxide will be lowered to 14 g/stp and the emission of hydrocarbons to 3.5 g/stp. In this case fuel consumption increases slightly.

Emissions of vehicles with a check weight of 850-1,020 kilograms and working engine volume $V_h = 1.2 \cdot 10^{-3}$ cubic meters already meet 1978-1980 norms when the K-127 carburetor is installed. 1981 norms are met by installing the K-133 carburetor on these vehicles (with AIS, EFSV, and ASaW). To meet the norms contemplated for 1985 the vehicle must also have systems for automatic air warming and exhaust gas recirculation (see Table 4 below).

Table 4

Antipollution Devices of Carburetors	Emission of Toxic Substances in g/stp CO	CH	NO_x
K-127M	51-65	4.4-7.9	7.4-9.1
K-133 (with AIS and EFSV)	41-58	3.7-6.4	6.4-8.2
K-133 (with AAW and EGRS)	37-45	3.8-5.5	3.3-5.9

The above-listed antipollution devices (the Ozon, K-151, K-131, and K-133 carburetors, systems for trapping fuel vapors, automatic air warming, and systems to neutralize and recirculate exhaust gases) are either in production by the automotive industry or being prepared for production.

Table 5 below gives existing and contemplated toxicity norms for cars and the various antipollution systems with which they are equipped.

Table 5

Models of Cars / Toxic Emission Norms	1981 CO	CH	NO_x	1985 CO	CH	NO_x
Norms:						
in g/stp	60	6.0	8.5	45	4.7	6.0
in g/km	14.8	1.48	2.10	11.1	1.16	1.5
VAZ	Ozon (with AIS, EFSV, ASaw, and PDT2C) and AAW			Ozon, AAW, STFV, and EGRS		
Moskvich	K-150 or Ozon, and AAW			K-150 or Ozon, AAW, STFV, and EGRS		
Norms:						
in g/stp	76	7.0	10.3	57	5.4	7.3
in g/km	18.8	1.73	2.54	14.1	1.34	1.8
GAZ-24 Volga	K-151 or Ozon, AAW, EGRS			K-151 or Ozon, AAW, STFV, and EGRS		
Norms:						
in g/stp	105	9.8	14.5	80	7.5	10.2
in g/km	26.0	2.42	3.58	19.8	1.85	2.52
UAZ	K-131 or Ozon, AAW, EGRS, for Export			K-131 or Ozon, AAW, EGRS		
Norms:						
in g/stp	50	5.4	7.5	37	4.2	5.3
in g/km	12.4	1.33	1.85	9.2	1.94	1.31
Zaporozhets	K-133 and AAW			K-133, AAW, and EGRS		

Thus, the antipollution devices that have been developed and are being incorporated in production, when properly combined, make it possible to keep the toxic emissions of domestically produced motor vehicles weighing up to 3.5 tons within not only existing but also contemplated norms.

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CSO: 1829

MOTOR VEHICLE

NEW HIGHWAY TO JOIN KAZAN', NABEREZHNYYE CHELNY

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 18 Dec 80 p 1

[Article by SOTSIALISTICHESKAYA INDUSTRIYA correspondent U. Bogdalov, Kazan': "Highway Under Construction"]

[Text] /A state commission accepted the new highway for full use. Extending 218 kilometers, it linked Kazan' with Naberezhnyye Chelny, the Nizhnekamsk Industrial Center, and oil regions./ /printed in bold face/

A wide black ribbon hisses beneath the vehicle's wheels. December snow flurries wind along the asphalt. Stretching away to the distant horizon, the road literally cuts the snowy steppe in two.

Mighty KamAZ [Kama Automobile Plant] vehicles are the most prevalent encountered in either direction. And, something remarkable, a close causal relationship exists between the birth of the road and the vehicle. Development of the highway project was envisaged in connection with construction of the Kama Automobile Plant.

We have been on the road for 1.5 hours. You don't even notice the 100 kilometers per hour speed. That this trip is a pleasure is evident from the driver's mood, from the way he sits relaxed behind the wheel.

The rainy October day was a memorable one for the road builders. Then the two asphalt strips had to be joined at the 93-kilometer point. The main hindrance here was those for whom the road was being built--the drivers. They travelled along the long-awaited, albeit unfinished, road, right on the roadbed ready to be asphalted. A detour road had to be built. Only in this way was it possible to complete the final hundreds of meters.

The state commission legalized the road's existence only after vehicle pavilions, gas stations, repair stations, and terminals in large population centers had been set up along its entire length.

The Kazan'-Naberezhnyye Chelny highway became the biggest project in the history of Kazdorstroy Trust. More than 12 million cubic meters of dirt had to be brought in and more than 2.2 million square meters of asphalt concrete surface poured. Six asphalt concrete and eight cement concrete plants supported construction of the road.

The new road also became an important event in the biography of the students at the Kazan' Engineer Construction and the Kazan' Veterinary institutes. They took care of reinforcing the concrete structures until mid-September. They assimilated more than R1 million.

. . . A bridge. Another. A reinforced concrete drain, then another bridge. We cross dozens of rivers, rivulets, and streams en route to the Kama. The route actually has 12 bridges and 152 drainage structures.

The biggest bridge over the Vyatka. The driver recalls hours and even full days wasted at the slow ferry crossing. These delays cost the national economy hundreds of thousands of rubles. A route over the Nizhnekamsk GES will open up in the near future.

The road goes through inhabited areas. Dozens of villages, settlements, and cities have now been linked into a single transportation network, the foundation for development of agriculture and industry. Moreover, the odor of gasoline and the roar of hundreds of vehicles will not bother local residents. The route by-passes cities and settlements, which are linked to it by means of easy access roads.

In less than 3 hours, we had reached the icy mirrored Kama. The automotive giant is but a stone's throw away across the river, nearby are Nizhnekamsk and Mendeleyevo--a mighty industrial center.

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CSO: 1829

UFA MOTOR VEHICLE PLANT

Moscow ZA RULEM in Russian No 10, Oct 80 pp 3-4

[Interview with Vladislav Dmitriyevich D'yakonov, general director of the Ufa Engine Production Association (UMPO): "The Third Million"]

> [Text] The Ufa Engine Production Association (UMPO) is one of the country's largest specialized automotive engine production enterprises. It has longtime traditions dating way back to the time of the country's industrialization, to our first five-year plans. Therefore, S. Mar'in, who conducted the interview with association general director V. D. D'yakonov, began "way back then."

[Question] Vladislav Dmitriyevich, as far as we know, your collective is ending the regular, tenth, five-year plan with high production indicators. They were noted in Leonid Il'ich Brezhnev's letter of greeting in which he addressed the association's workers regarding early fulfillment of the five-year plan where labor productivity growth and basic production volume were concerned. Now, as the country moves towards the 26th CPSU Congress and is on the eve of the 11th Five-Year Plan, let's look back and recall with what and how UMPO began. Then the picture of today's achievements will be more clearly focused.

[Answer] In July 1931 the USSR VSNKh [Supreme Council of the National Economy] Presidium issued a decree on construction of an engine plant in Ufa. From the very beginning it was to be a specialized enterprise to produce automotive diesels. In accordance with a USSR Gosplan decision the Ufa Engine Plant [UMZ] joined the ranks of the country's shock construction projects and manufactured its first product in 1935--U-5 engines for combines. The design of a diesel for a cargo truck that had to be assimilated still had not been completed and the plant began to manufacture a product that the national economy needed very badly.

Then during the war years we had to assimilate the exceptionally complex production of aviation engines.

[Question] Know-how from the war years, it would seem, was of great assistance when the UMZ returned in 1946 to peacetime production.

[Answer] Yes. The collective, having assimilated more technologically complex articles with higher classes of precision, entered the postwar period professionally mature and qualified. Again we began to make combine engines but, relying on our know-how and capabilities, at a different level. We used an aluminum rather

than a cast iron cylinder block, let's say. We produced the Model U5-MA until 1958. Along with it we assimilated production of the ZID-4.5 fixed engine for rural needs, lathes and threaders, and other articles the national economy required.

[Question] High production culture and a 30-year tradition of engine production were evidently very important factors when the UMZ was tasked in 1965 to produce Moskvich engines.

[Answer] We considered this a very respectable task and understood that it brought with it great responsibility. The collective was given a difficult assignment. Let me explain. Production culture and know-how, so to speak, could have helped if our job had been to produce automotive engines at the same scale as we had combine engines. During 12 postwar years we produced 140,000 U5-MA engines. On the average this was 10,000-12,000 engines annually of about equal complexity as those for the Moskvich. We were faced with making several hundred thousand automotive engines per year, i.e., to assimilate mass production of a rather complex article and to maintain high quality.

New sections supplied with the latest high-speed equipment were built at the UMZ. Our production of automotive engines has already been covered in the August 1973 issue of ZA RULEM.

[Question] How did engine production develop? How do you describe the dynamics, if one can use the term, of the growth of their production?

[Answer] The collective manufactured the first experimental consignment of 20 Moskvich-412 engines prior to 15 March 1966, the day the 23rd CPSU Congress opened. The new design underwent state testing in mid-1967 and the Moskvich with the Model 412 engine was accepted for production on 30 October 1967. By the end of the year the UMZ had produced 2,300 engines for Moskvich automobiles from the Izhevsk and Moscow plants.

Production was based upon so-called make shift technology while shop construction and installation and check-out of the high-speed equipment were in progress. In 1969 we gradually converted to the basic variant. By 20 August 1970 the 100,000th engine had already come off the assembly line, the one millionth came off on 4 August 1975, and the two millionth was produced on 17 July 1978.

[Question] Is the three millionth imminent?

[Answer] We plan to produce that jubilee engine early in February of next year, on the eve of the opening of the 26th CPSU Congress. I wish to direct your attention to this fact. We needed 9 years to produce the one millionth engine, only 3 years for the next million, we will expend 2.5 years on the third. Moreover, the serious, creative labor of a large collective stands behind these figures.

[Question] The 10th Five-Year Plan, Vladislav Dmitriyevich, as you know, is a five-year plan of quality. What has the association achieved in this regard?

[Question] The consumer has the last word here, evidently. He responds to sloppiness with complaints. Thus, the number of complaints we have had has dropped considerably compared to 1979. Nonetheless, these are no grounds for our becoming

complacent. We examine malfunctions and defects carefully in order to erect a reliable barrier against them. We are fully cognizant of our sins but, all the same, as analysis showed, 60 percent of the complaints are on the conscience of our collaborators.

Naturally, the UMPO does not manufacture the complete engine. It receives blanks and components from many specialized enterprises. We sell the Model 412 engine to customers--the AZLK [Automobile Plant imeni Lenin's Komsomol] and the Izhevsk Automobile Plant--in an assembly with the transmission and clutch, which we also get from other plants. In a word, we are in a long chain of enterprises upon whose joint work depends the quality of the finished product--the car. Let me enumerate those about whose product we get the most complaints. There is the Omsk Engine Plant imeni P. I. Baranov which supplies transmissions; the Volzhskiy Industrial Rubber Articles Plant, which supplies seals, and the Moscow ATE-2 [Moscow Auto-Tractor Electric Equipment Plant No. 2], which provides generators.

In certain instances we are not in a position to reject components. That is the case with the aforementioned generators. It is very difficult to check out the inner workings of a generator prior to an engine's installation in the vehicle. You are left to trust the manufacturer and at times he produces defective instruments.

Don't think for a moment that we just sit idly by. No defect goes by unnoticed, regardless of who is responsible. We regularly hold quality control conferences with collaborating agencies to solve our problems proficiently. We look into specific shortcomings and make specific decisions.

[Question] In this connection, perhaps this question is pertinent: are you satisfied with the quality of the camshaft drive chains?

[Answer] We have no complaints about those produced by the Daugavpils Motorcycle and Bicycle Chain Plant.

[Question] Tell me, what is the quality of the camshafts that you produce? We are interested in this since the guarantee of high durability of the "lobe-rocker journal" pair is one complex production problem.

[Answer] Practically speaking we have no defects involving camshaft lobe wear. Specialists from the supplying plants jointly with the UMPO developed the technology of a forged cast iron shaft, whose lobes are chilled to the requisite depth during the casting process and which have a hardness rated at least 65 units on the C scale of a Rockwell instrument. I repeat, we do not experience instances of their greater wear.

By the way, this problem was reflected in the complex of our design and engineering measures during the 10th Five-Year Plan to increase engine operating life. We achieved a more stable longevity and high durability of the "lobe-rocker journal" pair thanks to improvement in the entire technology of component manufacture.

[Question] Can you enumerate other measures in this complex, along with data which characterizes the rise in engine operating life?

[Answer] During the years of the 10th Five-Year Plan the service life of the Model 412 engine prior to major overhaul was increased from 125,000 to 140,000 kilometers, or 12 percent. We achieved this (besides using the measures I have enumerated already) as a result of introduction of more improved automated equipment, stabilization in the technological process of manufacture of a number of components, and conduct of a number of design and engineering measures jointly with suppliers. Among these I note introduction of seals made of 1314A rubber, A20D spark plugs with more stable traits, an improved starter, a carburetor with a better cold start system, a diaphragm-type clutch, and many others.

[Question] What is planned for the 11th Five-Year Plan along the lines of further improvements for the Model 412 engine and improvement in its reliability and longevity?

[Answer] Everything we are doing in this area--this concerns both engine design and technology--is being closely coordinated with the AZLK, where the project planning was done, and with the Izhevsk Automobile Plant, which along with the AZLK is our customer. In accordance with such joint plans, at the beginning of the 11th Five-Year Plan the intention is to accomplish a broad complex of measures.

Also envisioned in joint plans is development of modernized engines for perspective models from both plants. Their design will guarantee further improvement in technical and economic indicators, including an increase in reliability, a reduction in toxic emissions, and a decrease in article metals intensity.

I recall that we have assimilated production of a so-called stepped down engine variant, which has a lower degree of compression and is designed for A-76 gas. It is installed on the Moskvich-21403 (manual control), the Moskvich-21406 (a modification for rural locales), as well as in the IZh-2715 (with a bed for hauling small freight consignments) and the IZh-27151 (a pick-up). One stepped down engine modification has been awarded the state Quality Seal. Moreover, since 1978 the plant has been producing engines with a closed cooling system and a carburetor from the Dmitrovgrad Automotive Assembly Plant (DAAZ in place of the K-126).

[Question] And the final question: What are the perspectives for development of automotive engine production in the association?

[Answer] Last year we produced 390,000 engines. This year, the final year of the 10th Five-Year Plan, we must provide 401,000.

Of this number 186,000 will be shipped to the AZLK, 182,000 to the Izhevsk Automobile Plant, and the rest will be for spares. By the way, about spares. We are planning already this year to increase the production of spares 154 percent in total cost; moreover, pistons and the stepped down engine variant also will figure in this products list. As far as the 11th Five-Year Plan is concerned, we plan to produce 409,000 engines the first year.

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CSO: 1829

UDC 629.113:631.37

NEW TRANSPORTATION VEHICLES FOR AGRICULTURE REVIEWED

Moscow AVTOMOBIL'NAYA PROMYSHLENNOST' in Russian No 12, 1980 pp 1-3

[Article by Doctors of Technical Sciences Z. L. Sirotkin and Yu. I. Shalabin, Central Scientific Research Institute of Automobiles and Automobiles Engines: "The Automotive Industry Serves Agriculture"]

[Text] The transportation fleet of agriculture is receiving a steady stream of improved motor vehicles, trailers, and semitrailers produced by the automotive industry. Since 1966 the growth in number of motor vehicles in agriculture for each five-year plan has averaged 30 percent, while in terms of total load capacity the increase has been 40 percent. Specifically, the load capacity of all transportation equipment delivered to agriculture by the Ministry of Automotive Industry was 4.7 tons in 1978 (compared to 3.6 tons in 1975), and the average load capacity of tractor transportation equipment was six tons (5.2 tons in 1975). The power-to-weight ratio of motor vehicles delivered to agriculture has also increased. In 1980 it was 82.5 kilowatts, which is 40 percent higher than the ratio of motor vehicles produced in the Eighth and Ninth Five-Year plans. Increasing numbers of large load-capacity truck trains, dump trucks, specialized transport vehicles, tractor trailers, and semitrailers are being delivered. In 1980 work is being completed to build and introduce in production the means of transportation envisioned by the "System of Machines for Full Mechanization of Agriculture" in 1976-1980. This system, considering supplementary assignments, contains 137 models of transportation equipment in the competence of the Ministry of Automotive Industry. Of them 83 models are already in series production and 55 are in various stages of experimental design, including acceptance testing.

The transportation fleet should be significantly increased and modernized as the result of growth in the number of models of motor vehicles being produced and the organization of production of new and modernized means of transportation. This will create the prerequisites for improving transportation work in agricultural production. Work in this direction will continue in the 11th Five-Year Plan as demanded by the 3 July 1978 decree of the CPSU Central Committee and USSR Council of Ministers entitled "Steps Toward Further Development in Fully Mechanizing Agricultural Production and Equipping Agriculture with Highly Productive Machinery." This decree envisions the delivery of 1,450,000 trucks with a total load capacity of 6,950,000 tons to agriculture

in the new five-year plan. In addition, this follows the July 1978 Plenum of the CPSU Central Committee which posed the challenge of supplying large load-capacity motor vehicles and specialized agricultural vehicles to the countryside. For the automotive industry these tasks have become one of the most important, top-priority challenges. The following steps are being taken to accomplish them:

1. increasing the proportion of motor vehicles with large load capacity (eight tons and more) suitable for work on poor roads in the total vehicles produced;

2. expanding the production of vehicle trailer equipment with relatively large load capacities (up to 14 tons of load capacity for semitrailers and up to eight tons for trailers);

3. development of deliveries of specialized vehicles that make it possible to raise the technical level of transportation shipping and its efficiency and preserve loads during delivery to the customer;

4. establishing in the tractor fleet of agriculture an assortment of trailer equipment that will make it possible to form optimal (from the standpoint of load capacity and traction capabilities of the tractor) trains for use in the full range of road and climatic conditions, that is, expanding the list of tractor trailers produced and improving their designs, specifically by modernizing braking systems to make it possible to use three-unit transportation trains when necessary.

Roughly two-thirds of the freight traffic in agriculture is in-farm hauling where vehicles are used under field conditions, on ground with low carrying capacity; one-third is shipping on better roads (large-scale delivery of agricultural output to consumption or processing points). These characteristics of transportation operations in agriculture were taken into account in working out the program for development of the production of means of transportation for the countryside and in carrying out this program.

For example, the Kama Association for Production of Heavy-Duty Trucks was formed primarily to produce large load-capacity transportation vehicles for the country's entire road system. As a result, the vehicles produced by this association became one means of increasing the productivity and efficiency of transportation in agricultural production. This works out well: the load capacity of a KamAZ [Kama Truck Plant] truck train with a stake bed and up to 11 tons loaded on the back axle is now 16 tons and the capacity of a saddle-type truck train with semitrailer is 14 tons, whereas the maximum load capacity of the ZIL [Moscow Automotive Plant imeni I. A. Likhachev] saddle-type truck train used in agriculture is no more than 7.5 tons. Plans call for the Kama Truck Plant, the Neftekamsk Dump Truck Plant, and the Krasnoyarsk Vehicle Trailer Plant to produce truck trains with load capacities of 14 tons for agricultural needs. They will consist of a dump truck-tractor with a load capacity of seven tons and a dump trailer. The Kama Truck Plant is also to incorporate and develop the production of full-drive trucks which will be used

extensively in agriculture because during the period of large-scale agricultural work they can be operated with two trailers of eight tons load capacity, thus creating a truck train with a total load capacity of 23 tons.

About half of the in-farm hauling in agriculture is done by tractor trains whose productivity, in view of the fairly low speed, cannot be considered optimal. The other half of in-farm hauling is done by transportation vehicles which are operated during those seasons when road and weather conditions permit. Foremost among these vehicles are dump trucks with load capacities of 5.5, 7, and 10 tons which are figured to work as part of a unified production process with other agricultural machinery. They are full-drive transportation vehicles that can be used with or without trailers. The Kutaisi Automotive Plant imeni G. K. Ordzhonikidze is to set up production of dump truck-trains (4 x 4 type tractors and trailers for them) with a total load capacity (depending on operating conditions) of 11-12.5 tons.

The design of the truck-tractor reflects the leading trends in contemporary motor vehicle building and brings together many promising developments from NAMI [Central Scientific Research Institute of Automobiles and Automobile Engines]. The truck has evenly loaded axles with a maximum load per axle of six tons, a 118 kilowatt diesel engine, an eight-speed transmission and one-stage transfer box, a drive axle of advanced design equipped with a differential blocking mechanism, a modern cab, improved brake system, up-to-date steering mechanism, and a frame made of steel with a heightened yield point. The new wide radial tires developed according to NAMI technical specifications reduce fuel consumption, improve off-road capability, and keep unit pressure on the ground within the necessary limits.

The tractor and trailer are equipped with standardized beds that have additional inserted side risers and reinforcers. As a result the truck trains can haul practically the full range of basic agricultural loads ~~making~~ full use of load capacity (volumetric weight between 0.4 and 0.8 tons per cubic meter). Special modifications of the truck train are equipped with an automatic side opening and closing system and units for efficient work with modern silage-harvesting combines.

The Ural Automotive Plant is building capacities to produce 6 x 6 type vehicles for work as part of truck trains with load capacities of 12.5-14 tons and 8 x 8 type vehicles for use in truck trains with load capacities of 17 tons. The former is built on the basis of a series-produced vehicle with high off-road capability and is designed for efficient performance of transportation work in agricultural production; when equipped with a special unit it can apply mineral fertilizer to the soil. In its hauling variation it is a dump truck with a load capacity of seven tons that can unload on two sides and is calculated for work under field and bad road conditions with a trailer with load capacity of 5.5 tons and on highways with a trailer that has a load capacity of seven tons. The truck has a broad range of speeds (from 3 to 65 kilometers an hour) and excellent off-road capability over plowed land because of tires with regulated pressure. The vehicle has a diesel engine of about 155 kilowatts (it will later increase to 192 kilowatts) and mechanisms for synchronous and dependent power takeoff to drive various industrial units.

The 8 x 8 truck has a load capacity of 10 tons and can haul a trailer with a load capacity of seven tons over all kinds of roads and under field conditions. The beds of both the truck and the trailer are equipped with inserted side risers of various designs (applicable to the particular type of load being hauled) for hauling agricultural crops with low volumetric weight.

Switching GAZ [Gor'kiy Automotive Plant] and ZIL trucks, which are the most commonly used in the countryside, to diesel engines will also be very helpful to agriculture. The comparatively large power output of the diesel engines of these trucks (up to 92 and 118-136 kilowatts respectively) makes it possible to use them extensively in large-capacity truck trains (with load capacities up to nine tons for the GAZ and up to 11-14 tons for the ZIL).

Thus, two- and three-axle trucks planned to work with trailers and semi-trailers are gradually becoming the principal types of vehicles for agricultural purposes.

Broad use of trailers is also a major reserve for raising labor productivity in agriculture (70-80 percent), reducing the prime cost of hauling (15-25 percent), and saving fuel (as much as 20-25 percent). Therefore, in the last five years the volume of trailer equipment delivered by the Ministry of Automotive Industry has increased more than 2.1 times for trailers with walled beds, 1.2 times for dump trailers, 1.3 times for semitrailers with walled beds, and 1.3 times for tractor trailers and semitrailers. Production capacities for trailers to be used with trucks in agriculture are now being built at the Krasnoyarsk Trailer Plant, the Stavropol' Trailer Plant, the Voroshilovgrad Vehicle Assembly Plant imeni 60-Letiya Sovetskoy Ukrainy, and several others.

Special attention is now being focused on expanding the production of tractor trailers with large load capacities, chiefly for the T-150K, K-700, and K-701 tractors in the three and five ton traction classes. Evidence of this is seen in work to increase the load capacity of the series-produced tractor trailers with load capacities of nine and 12 tons; this work has increased the capacity of each trailer by one ton and reduced their materials-intensiveness by 434 and 475 kilograms respectively. At the same time an original design for a new trailer with a load capacity of 14.5 tons has been formulated. This design makes it possible to increase the hitching power of the tractor so that it is able to pull a train with a load capacity of 27.5 tons, making full use of its traction capacity. Plans envision incorporating production of these broadly standardized trailers at the Orsk Tractor Trailer Plant, the Balashov Truck-Tractor Trailer Plant, the Frunze Vehicle Assembly Plant, and the Ishim Machine Building Plant.

Plans also call for plants of the sector to incorporate new designs of the most widely used one- and two-axle trailers with four tons load capacity for tractors in the 0.9-1.4 ton traction class. These designs have gone through state testing and have been recommended for series production. The trailers have traction-hitching devices, pneumatic brakes, and pneumatic and electrical connections to the last trailer, which will make it possible to use them efficiently in multiunit tractor trains. The dimensions of their dumping beds, which have a set of inserted side risers, allow them to haul

a broad range of agricultural loads with low volumetric weight. For example, one model in this family of trailers has a bed capacity of 45 cubic meters and can be used to haul crushed straw from grain-harvesting combines. In addition, the Groznyy Transportation Machine Building Plant is planning to produce two-axle tractor trailers with a load capacity of six tons.

The Ministry of Automotive Industry in cooperation with the USSR Goskomsel'khoztekhnika has worked to devise modifications of the GAZ, ZIL, and KamAZ trucks with walled beds and trailers for hauling grain without losses during the harvest time. The walled beds of these trucks have side reinforcers, solid inserted side risers, and canopies.

The automotive industry is contemplating a significant expansion of the production of specialized trucks and trailers for agricultural needs. By 1985 the assortment of such machinery will increase sharply. The equipment will be made more efficient, chiefly through an increase in load capacity, better adaptability to the specific features of the load being hauled, and mechanization of loading and unloading.

For example, four models of one- and two-level semitrailer-vans, based on ZIL and KamAZ trucks, are contemplated for hauling cattle, sheep, and goats. The capacities of the new semitrailers are 45 percent greater than those produced today, shipping conditions for the livestock are improved, and the labor-intensiveness of the loading and unloading operation has been reduced.

The new vans being built on the ZIL-133GYa frame for hauling incubation eggs and live poultry in containers have doubled the capacity of the van built on the GAZ-53A frame. The new vans have a climate control system (heating, ventilation, and air humidifiers) and lift gates.

New vans are also being built to ship perishable freight, vegetables, and fruit in containers. Their beds have contemporary heat engineering characteristics because polyurethane foam is used for insulation. Refrigerator semitrailers with large load capacities (from 8.3 to 22 tons) are also being built for the ZIL, KamAZ, and MAZ [Minsk Automotive Plant] (6 x 4) saddle-type tractors. Aluminum alloys and polyurethane foam injected directly into the walls of the bed are used. Many of them, for example, the refrigerator truck built on the GAZ-66 frame (4 x 4) can deliver perishable loads where there are poor roads or none at all.

New trucks and truck trains are being built to haul water to remote summer pastures. At the present time the tanker with 3,600 liter capacity built on the GAZ-53A frame is the only vehicle produced for this purpose. Plans call for setting up production of a tanker semitrailer with a capacity of 13,300 liters to be used with the KamAZ-5410 truck tractor and a tanker truck with 4,000 liters capacity built on a KAZ [Kutaisi Automotive Plant] (4 x 4) frame.

New, highly productive tanker trucks, trailers, and semitrailers are being developed to haul petroleum products. The total capacity of a truck train consisting of a tanker on a ZIL-130 frame and a tanker trailer will be 11,200 liters; the total capacity of a train consisting of a tanker on a KamAZ-5320 frame and a tanker trailer will be 16,600 liters. The refueling

truck train consisting of a tanker truck on a ZIL-130 frame and a tanker trailer (10,600 liters) and the truck train consisting of a tanker truck on a KamAZ-5320 frame and a tanker trailer (16,000 liters) have slightly lower capacity because of the need to carry special fuel pumping equipment.

New tankers for transporting fuel and refueling will significantly increase the efficiency of shipping in comparison with the tanker trucks now used built on GAZ-53A and GAZ-66 frames.

The Ministry of Automotive Industry is for the first time incorporating four models (with load capacities between 4.5 and 13.5 tons)of tanker semitrailers (two for tractors and two for trucks) to haul liquid mixed fertilizers.

A heavy equipment semitrailer for use with the KamAZ-5410 truck is being built to haul combines and agriculture machines. It will make it easier to solve problems of transporting agricultural machinery for repair and other purposes.

Solving all these problems will require considerable effort, creative initiative, and a high level of organization and production discipline from the employees of the automotive industry. But these problems will be solved, because the interest of developing agricultural production, the interests of the entire Soviet people, demand it.

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CSO: 1829

MOTOR VEHICLE

BRIEFS

NEW BATTERY SALES PROCEDURE--TASS reports that the USSR Council of Ministers passed a decree in accordance with which sale of new automotive lead storage batteries to kolkhozes, sovkhozes, and other agricultural organizations and enterprises, as well as to citizens, after 1 January 1982 will be accomplished only when a worn-out battery is turned in. The cost of the lead contained in the batteries turned in will be paid to car owners based on the procurement price for domestic scrap lead. Measures are envisioned in the decree to organize the collection of used and sales of new batteries. [Text] [Moscow SEL'SKAYA GAZETA in Russian 6 Jan 81 p 3] 7869

ROAD THROUGH THE TUNDRA--El'ta reports that the republic's envoys in Tyumenskaya Oblast have begun an 80-kilometer long road. It will link the oil workers' future city of Kogolym with the oil fields. "The temperature in Kogolym drops to -10°," says P. Makritskas, first deputy minister of motor transport and highways, who visited there recently. "However, our republic's representatives, headed by experienced engineer A. Yankauskas, continue working. They prepared fill for the railroad siding to their production base, fall logs, and deliver dirt." Part of the group is expanding the construction workers' temporary settlement. Along with small heated cars, the first prefabricated panel houses, built at the Kaunas Production Enterprises Combine, have been built here already. Several more such structures, as well as structural elements for a large wooden hostel, are en route to Kogolym. Additionally, the ministry sent trucks, bulldozers, and excavators to the specialized administration. A new detachment of Soviet Lithuania's road builders will be dispatched to Tyumen' during the spring. [Text] [Vilnius SOVETSKAYA LITVA in Russian 24 Dec 80 p 4] 7869

ADDITIONS TO BUS FLEET--In 1980 the capital is receiving approximately 1,500 Ikarus, LAZ [L'vov Bus Plant], and LiAZ [Likino Bus Plant] vehicles. The total number of buses serving the city's 460 passenger lines will reach 7,600. The Ikarus-280, which was tested recently in Moscow, now has arrived in large numbers. Each carries up to 150 passengers. Tests now are underway of an articulated trolleybus variant--a new model from the Plant imeni Uritskiy. [Text] [Moscow ZA RULEM in Russian No 10, Oct 80 p 8] 7869

SHUMEN TRUCKS---The Madara Cargo Vehicle Combine in the city of Shumen, which assembles more than 3,000 GAZ-53A annually, produced its 35,000th vehicle. Madara was built through economic and technical cooperation with the Soviet Union. The combine maintains close ties with the Gor'kiy Automobile Plant and other Soviet automotive enterprises which supply units and components. Shumen auto-makers planned to produce the 40,000th GAZ-53A cargo truck prior to the 12th Congress of the Bulgarian Communist Party. [Text] [Moscow ZA RULEM in Russian No 10, Oct 80 p 8] 7869

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